ADAMA SCIENCE AND TECHNOLOGY UNIVERISTY

OFFICE OF GRADUATE STUDIES

Water Supply Sanitization and Prevalence of Waterborne Diseases in Ude Rural Town, Oromia Regional State, Ethiopia

A Thesis

Submitted to the Department of Applied Biology

School of Applied Natural Science

In Partial Fulfillment of the Requirement for the Degree of Master's in Biology

By

Zinash Dessie Tefera

Adama, Ethiopia

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ACKNOWLEDGMENTS

First of all, I would like to thank my advisor Dr. Danial Getahun for his proper follow up, simplicity, constructive and encouraging advice at every stage during the preparation of this paper and thanks to Adama sciences and Technology University for the accomplishment of this research work. My gratitude also goes to Oromia Health Breaue and Adea Woreda Administration for facilitating conditions to collect data and Adea Health center workers that gave valuable data for study. My gratitude also goes to all friends who constantly supported and encouraged me with several constructive ideas at different stages of this thesis work in data collection and for language translation.

Approval of Board of Examiners

We, the undersigned, members of the Board of Examiners of the final open defense by zinash DessieTefera have read and evaluated his/her thesis entitled " water supply Sanitatization and prevalence's f waterborne diseases in Ude rural town Oromia Regional State, Ethiopia and examined the candidate. This is, therefore, to certify that the thesis has been accepted in partial fulfillment of the requirement of the Degree of Sciences in Biology

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Declaration

I hereby declare that this MSc Thesis is my original work and has not been presented for a degree in any other university, and all sources of material used for this thesis have been duly acknowledged.

Name: Zinash DessieTefera

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This MSc Thesis has been submitted for examination with my approval as thesis advisor/ Supervisor.

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Supervisor's/Advisor's approval sheet

To: .....Department

Subject: Thesis Submission

This is to certify that the thesis entitled "Water supply sanitization and prevalence's of waterborne diseases in Ude rural town, oromia regional state, Ethiopia" submitted in partial fulfillment of the requirements for the degree of Master's of Sciences in Biology the Graduate program of the Department of Applied Biology and has been carried out by Zinash Dessie Tefera, Id. No GSU 0414/06, under my/our supervision. Therefore, I/we recommend that the student has fulfilled the requirements and hence hereby he/she can submit the thesis to the Department.

Name of major Advisor/supervisor_____

Signature_____

Date_____

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ABBREVIATIONS

CSA	Central Statistical Agency
HWTS	Household Water Treatment and Safe Storage
IWSC	International Water and Sanitation Center
IFAD	International Fund for Agricultural Development
MDG	Millennium Development Goal
MDGs	Millennium Development Goals
MOH	Ministry of Health
MOWR	Ministry of Water Resources
POU	Point of Use
NTU	Nepholometric Turbidity Unit
ORS	Oral Rehydration Solution
UNDP	United Nation Development Policy
UNICEF	United Nation Children Fund
WHO	World Health Organization

ABSTRACT

Lack of sustainability of water supply and sanitation services are always considered as major issues in developing countries that account for high prevalence of waterborne diseases. Contaminated water consumption and poor environmental hygienic practices are the leading causes of death in developing countries, including Ethiopia which might be the influential factors associated with prevalence of waterborne diseases. This study aims to assess the association between water and sanitation with prevalence of waterborne diseases in the study area. The data was collected by self prepared questionnaire of trained data collector, interview and personal observation. Data were presented by using table, frequency with percentage and Figures and analyzed with SPSS version 20. The result indicated that 88.4% of residents obtain water from well. Most of (77.9%) use this water for drinking without any treatment. The people in the study area had no habit of covering the well and throw their wastes everywhere. The most prevalent waterborne diseases were typhoid fever, ameboisis and giardiasis. Additionally, the result indicated that toilets have no water facility and awareness of respondents towards waterborne diseases is poor. Finally, Environmental hygienic practices and water sanitation practices are influential factor for the occurrence of waterborne diseases in the study sites. Awareness programs give by health workers should be related to use of water treatment, water quality, and importance of use of toilets, proper disposal of swages mechanisms and cause and prevention of water borne diseases that should be carried out in the rural areas to improve the status of public health. Furthermore, water and environmental sanitation studies should be conducted on a regular basis to assess risks of contamination of water sources.

Key words: Ude rural town, Ethiopia, waterborne diseases, water sanitation, well water

1. INTRODUCTION

1.1 Background of the Study

Water is a basic need in sustaining life. Safe, reliable, affordable, and easily accessible water supply is essential for good health. Safe drinking water for human consumption should be free from pathogens such as bacteria, viruses and protozoan parasites, meet the standard guidelines for taste, odor, appearance and chemical concentrations, and must be available in adequate quantities for domestic purpose. However, inadequate sanitation and persistent faecal contamination of water sources is responsible for a large percentage of people in both developed and developing countries are not having access to safe drinking water and suffering from diarrhoeal diseases. Diarrhoeal diseases are responsible for approximately 2.5 million deaths annually in developing countries, affecting children younger than five years, especially those in areas devoid of access to potable water supply and sanitation (WHO, 2002). According to the World Health Organization (WHO, 2014) and United Nations Children's Fund (UNICEF, 2014) Joint Monitoring Programmers for Water Supply and Sanitation estimates that around 1.1 billion people worldwide do not have access to improved water supply sources whereas, 2.4 billion people do not have access to any type of improved sanitation facilities.

The most affected people in developing countries living in extreme condition of poverty, normally peri-urban dwellers or rural inhabitants. Every year more than 3.4 million people die as a result of water-related diseases, making it the leading cause of morbidity and mortality around the world. Most of the victims are children that caused by organisms that thrive in water sources that contaminated with pathogens, physical and chemical contaminants at the source during distribution, transportation and handling in households or unless used without treatment (WHO, 2007). Several studies have documented the significant positive effect of water and sanitation on reducing child diarrhea (Esrey *et al*., 1991; Fewtrell *et al*., 2005; Waddington *et al*., 2009). Moreover, improved water and sanitation has been shown to lower the health risks related to schistosomiasis, trachoma, intestinal helminthes and other water related diseases.

In addition, improved water and sanitation is likely to reduce the burden of disease related to other major health issues by reducing the average stress level for the immune system, and thus strengthening the immune response to new infections. While diarrheal studies provide important information about the immediate health effects of water and sanitation, the link from water and sanitation to child mortality is in direct and cannot directly be derived from estimates on child diarrhea.

Among the main problems which are responsible for this situation are lack of priority given to the sector, lack of financial resources, lake of water supply and sanitation services, poor hygiene behavior and inadequate sanitation in public place including hospitals, health centers and schools that provide access to sufficient quality of safe water. Southern Asia and sub-Saharan Africa still struggle with low coverage in sanitation, 41% and 30% respectively (WHO and UNICEF, 2010).

Ethiopia is found in sub-Sahara countries in the world with the worst of all water quality problems. It has the lowest water supply and sanitation coverage in sub-Saharan countries with only 68.5% and 56% for water supply and sanitation, respectively (MoWR, 2010)**.**In Ethiopia drinking water coverage is less than or equal to 21% for the rural, 84% for the urban and 30% for the country level. The per capita per day water consumption ranges from 3 to 20 liters with median of 8.5 liters (Abera and Mohamed, 2005).Three-fourth of the health problems of children is communicable diseases arising from the environment, especially water sanitation (IWSC, 1989). In rural areas and villages of Ethiopia, water for human consumption for drinking, washing (bathing, laundry) and for preparation of food, etc, is obtained from rivers, streams, shallow wells, springs, lakes, ponds, and rainfall, but these water sources are contaminated with human excreta, animal waste and effluent because of open field defecation practices. Thus, the majority of rural communities and semi urban area use contaminated water, which exposes the people to various waterborne diseases (MoWR, 2010).

Waterborne diseases can be caused by protozoa, viruses and bacteria. Waterborne diseases caused by protozoa include amebiasis, cryptosporidiosis, cyclosporiasis and giardiasis. Waterborne diseases caused by parasitic worms include Schistosomiasis, dracunculiasis, taeniasis, fascioliasis, *Hymenolepiasis nana*, ascraiasis, entrobiasis and hyatidosi. Bacterial waterborne diseases include cholera, botulism, campylobacteriosis, Typhoid and Dysentery (Bitton, 2014).The most common water borne diseases that produce significant health problems in all parts of Ethiopia include: typhoid fever, bacillary dysentery, cholera, poliomyelitis, hepatitis A, hepatitis E, Viral and bacterial gastroenteritis, amebiasis, and giardiasis (Leclerc *et al.*, 2003).

The major water related diseases in Ethiopia are diarrhea, hepatitis, roundworm and hookworm infections, trachoma, guinea worm, schistosomiasis, leishmaniasis, lymphatic filariasis, cholera and malaria. Thus, poor environmental sanitation and water quality play an important role in spreading the infectious diseases, which are presently emerging and creating a big public health problem. The quality of available water, increasing demand of water due to population growth, industrialization and agricultural development pose further new challenges to Ethiopia.

During the dry season, more traditional sources of water are placed under pressure as shallow wells or other perennial sources dry-up. This situation worsens as these sources of water supply are shared with livestock. Taken together, rates of morbidity and mortality in rural areas is particularly high since few have access to improved water supply, sanitation facilities, and awareness of hygienic practices. Most of the population of Ethiopia does not have access to safe and reliable sanitation facilities. Majority of the households do not have sufficient understanding of hygienic practices regarding. As a result, over 75 % of the health problems in Ethiopia are communicable diseases which resulted from having unsafe and inadequate water supply (UN-WaterWWAP, 2004).

Several studies on deterioration of water quality during the storage, transport of water, poor hygiene practices contamination, inadequate household toilet, hand-washing facilities and poor community environmental sanitation results of poor sanitation around households, commonly used transport and storage containers are easily contaminated (Sobsey, 2002). Assessments of the contamination level of water at collection point and determination of the major contaminants are factor for influences of prevalence of waterborne diseases (Birhanu and Manyawkal, 2008). Currently, in our study area researches conduct on water handling practices, environmental sanitation practices associated with the prevalence of waterborne diseases in rural areas where communities have to use well water as easily contaminated with environmental pollutant under luck of covering habits that link with health as prevalence of diarrheal diseases. But there are no published studies on the link with them. The present study focused on Oromia region Adea district rural town community use well water source for domestic purpose but water sources are unsuitable for human consumption easily contaminated due to poor sanitation hygiene and environmental factor which is vulnerable to waterborne diseases (Ude Health Bureau 2016, unpublished data). This study also assess on water sanitation practices and the association between water sanitation and prevalence of water borne diseases.

1.2 Statement of the problem

According to UNICEF's report in 2014, showed 1.1 billion people throughout the world did not have enough water and 2.4 billion people lived without adequate sanitation. The situation was much worse in the rural areas than in the urban areas. In 2014, the percentage of those with an adequate supply of water was found to be 95% in urban areas and 93% in rural areas worldwide. From the year 2014, the percentage of water supply and sanitation in the world have increased in the urban areas but situation in the rural area changed. Even though water scarcity is a worldwide problem, urban poor and rural inhabitants are at the fore front to be affected by the problem of poor access to potable water and basic

sanitation. This is also the situation in rural Ethiopia, where women and children walk for hours to collect polluted water from shallow and unprotected ponds, well, unprotected springs, and rivers, and in some areas they share the same water sources with their animals. All of these sources are subject to contamination as rainwater washes wastes from surrounding areas in to the sources. In addition to the time they spend, as a result of poor access to potable water and basic sanitation, people are becoming unhealthy which leads to loss of productivity. It is not debatable that the poor access to potable water and basic sanitation is affecting lives of many in rural Ethiopia.

Ada'a district is one of the Ethiopian rural places where the community does not have access to potable water, poor sanitation facility. Thus, the communities are forced to use water from unprotected well water and collected rain water which they may share with their animals that easily contaminated it. The researcher visited the study area and recognized that the community is highly affected by lack of access to potable water supply, manageable disposal of wastes. Accordingly, the community is obliged to use improved sources of water for drinking, cooking, and maintaining adequate standards of hygiene, but believed that unsafe drinking water is as risky for health. Thus, people use unsafe water easily exposed to waterborne and water related diseases. Therefore, the issue of access potable water and basic sanitation has to get attention from the responsible authorities as well as the community itself. Thus, this study tried to assess the real situation in the area regarding to water sanitation and availability on the assessment of water sanitation of well water hygiene for consumers and investigates the association between water sanitation and prevalence of water borne disease.

1.3 Objectives of the study

1.3.1 General objective

The general objective of the study is to assess the association of water supply sanitization and prevalence of waterborne diseases in Ude town, Ada'a district, oromia Regional State.

1.3.2 Specific objectives

This study has the following specific objectives:

1. To describe major water sources that households use domestic purpose.
2. To describe water handling practice and sanitary condition of households.
3. To identify the major waterborne diseases that affects the community.
4. To recommend good intervention methods to eliminate waterborne diseases and improve sanitation.

1.4 Research Questions

The research questions are:

1. What is the source of water used domestic purpose including drinking by the community?
2. What is the hygienic condition of open well water used by the community?
3. What is the attitude of community about water sanitation related to waterborne diseases?
4. What are the factors which influence the prevalence of waterborne diseases?
5. What are the common diseases found in the town?
6. What is the prevalence of these common diseases?

1.5 Scope of the study

The study is limited to Ude rural town of Ada'a district because of time and financial constraints.

1.6 Significance of the study

The result of this study is helpful to communities in assess use of well water sources for domestic purpose, to create awareness of about water sanitation, manage proper disposal of swage, use of water treatments and to investigate prevalence of waterborne diseases. Moreover, this study can be used as reference by other researchers to conduct similar studies.

2. LITERATURE REVIEW

2.1. Water and sanitation

Safe drinking water is important as a health and development issue at national, regional and local levels. In some regions, it has been shown that investments in water supply and sanitation can yield a net economic benefit, since the reductions in adverse health effects and health care costs outweigh the costs of undertaking the interventions. This is true for major water supply infrastructure investments through water treatment in the home. Experience has also shown that interventions in improving access to safe water favor the poor in particular, whether in rural or urban areas and can be an effective part of poverty alleviation strategies (WHO, 2004). The WHO report indicates that globally, the percentage of people served with some form of improved water supply rose from 79% (4.1 billion) in 1990 to 82% (4.9 billion) in 2000 (WHO, 2000). The same report indicated that over the same period, the proportion of the world's population with access to excreta disposal facilities increased from 55% (2.9 billion people served) to 60% (3.6 billion). Hence, at the beginning of 2000, 1.1 billion people of the world's population was without access to improved water supply and 2.4 billion people lacked access to improved sanitation.

Several authors have indicated that diseases caused by contaminated water are the major threat in developing countries. Esrey (1985) has noted that contaminated water sources can serve as a vehicle for the transmission of pathogens to human. More than 1.2 million of people deaths in developing countries are caused by drinking water especially from highly contaminated sources (Ngoma, 1992). Of the 37 major diseases in developing countries, 21 have been reported to be related to water and sanitation. In Ethiopia the World Health Organization reported that some 4.2 million people suffered from acute lack of water (WHO, 2004). The lack of access to safe drinking water and sanitation places a heavy burden on children who are especially vulnerable to diarrheal disease. According to the Ethiopian Ministry of Health (FDRE, MoH, 2001), diseases related to water, sanitation and hygiene problems are among the leading causes of morbidity and mortality. Water quality was recognized as the foundation for any health improvement strategy, accompanied by programs for increased water quantity and sanitation. However, in the absence of changes in personal behavior and hygiene practices, the incidence of water-related diseases, for which the fecal-oral route is a major source of disease transmission, likely to remain high in contaminated environments (Esrey and Habicht, 1986).

According to the World Bank, 70 percent of the world's poor people live in rural areas. Thus, if development is to be achieved, attention should be given to rural water supplies and sanitation since any development activities address the poor. About 85 percent of Ethiopian people are estimated to live in rural areas, thus, the above data explains that only 26 percent from these 85 percent of population have access to potable water and basic sanitation. Water and sanitation coverage in rural areas is very low but 70 percent of the world poor population live in such areas, and therefore for development to be achieved due consideration should be given to these 70 percent of the world's poor population. In rural Ethiopia, efforts are made to provide financial assistance to rural districts which helps establish water supply and sanitation committees and build facilities (World Bank, 2014).

Despite this assistance by the World Bank and other aid organizations, and the Ethiopian government to increase the easy access to potable water supplies and basic sanitation in rural areas, there are still rural districts that do not get potable water and basic sanitation. There are rural areas which consider having ease access to potable water and basic sanitation as a privilege rather than as a right. The other challenge in providing potable water services and increasing basic sanitation access to rural areas are infrastructural problem. As Buddeke(2010) stated, socio-economic developments closely linked to infrastructure which many rural areas lag far behind. Ease of access to potable water and basic sanitation is one type of infrastructure which also depends on the other types of infrastructure like roads. Thus, the unavailability of such infrastructure is a challenge to any private or government organizations.

2.2 Water and sanitation versus development

The inclusion of access to potable water and basic sanitation in the MDGs for sustainable development shows that water and sanitation are important development indicators. It is a fact that infrastructure development and socio-economic developments are much related. Infrastructure development may include road construction, water and sanitation improvements, and irrigation development. Thus, having access to such services is considered as a pre condition for economic development. Accordingly water and sanitation infrastructures also have impact on the economic, social and human development of a nation. National governments are very aware of the expenditure needed to increase the access to improved water and sanitation but they are not curious about the economic costs of the negative consequences of unimproved water and sanitation. If the world population had access to safe drinking water and appropriate sanitation, the child mortality rate would be minimized. As a result of poor water and sanitation many people in the world are insecure; additionally potable water and basic sanitation is the easily preventable way of reducing child mortality. Access to clean water and sanitation is also a

means to reduce health related costs, improving girl's education, and it also ensures a sense of human dignity (UNICF, 2014).

2.3 Reasons for poor water supply sanitation

2.3.1 Economic reasons

It is clear that human waste is potentially dangerous material which needs to be managed properly. But there are some factors which may prohibit people from adopting toilet services. Though economic status inhibits people to build their own toilet, on the other hand this shows that, people do not realize the costs they spend on treating diseases caused by unsanitary environment, which the costs for curing might be higher than preventing. So investing on toilet is also a means of minimizing expenses of medication that comes after unhealthy living environment (Mcconville, 2003).

2.3.2 Socio-cultural reasons

There are also socio-cultural reasons why people do not adopt toilet use; 'what is dirty and clean can vary from culture to culture'. As a result people may prefer to defecate away from their houses in the fields which are considered more sanitary. Of course, it might be difficult to change long ingrained behavior dictating defecation practices; without proper support people will revert to old habits. The practice of open defecation is ritualized and bound in tradition (Mcconville, 2003).

2.4 The microbiological quality of water

Water supplies in developing countries are devoid of treatment and the communities have to make use of the most convenient supply. Many of these water supplies are unprotected and susceptible to external contamination from surface runoff, windblown debris, human and animal faecal pollution and unsanitary collection methods. Indicator organisms are used to assess the microbiological quality of water supply. In order for a microorganism to be used as an indicator organism of pollution, the following requirements should be fulfilled (WHO, 1993).

The concentration of the indicator microorganism should have a quantitative relationship to risk of disease associated with exposure (ingestion/recreational contact) to the water; The indicator organism should be presences of pathogens, should not reproduce in the environment; present in higher number in contaminated water; resistant to adverse environmental conditions, disinfection and other water treatment processes as pathogen, non-pathogenic and easy to quantify. The indicator organism should be specific to a faecal source or identifiable as to the source of origin of faecal pollution (Sobsey, 2002).

2.5 Sources of water pollution

The primary source of microbial pollution in agricultural watersheds is fecal matter from livestock production. The microbial loading potential from point sources such as storage facilities and feedlots and from non-point sources, such as grazed pastures and rangelands is substantial (Jamieson *et al*., 2004). Source areas can be divided into four categories areas where manure is surface applied areas where, manure is incorporated into the soil, areas where manure is directly deposited by livestock, and non-manured areas (Walker *et al*., 1990). Although a variety of protozoa and bacteria can be shed by livestock and transmitted to humans through water, animal and agriculture are likely responsible for a percentage of many of the pathogens we find in surface water but, whether that percentage is 5%, 50% or 95% compared to non-agricultural sources such as humans or wildlife is unknown at this time for most watersheds (Edward, 1995).

2.6 Microbial contaminants

Water is essential for life; unfortunately not all water helps people to survive. Water from contaminated sources may cause numerous diseases and untimely deaths. The fact that people needs water and cannot live without it, forces them to use it even for drinking purposes, whether clean or contaminated. As a result, people suffer from water-borne diseases especially in Ethiopia. The contaminants are mainly microbial pathogens. In rural villages and urban areas of Ethiopia, the main contaminants are from human excreta, animal waste, and liquid waste from factories, garages and pesticides from different sources. Water sources contaminated with these wastes are not fit for human use and large variety of bacterial, viral and protozoan pathogens are capable of initiating waterborne infections. The enteric bacterial pathogens include early recognized agents, such as *Salmonella* and *Shigella* species and newly recognized pathogens from fecal sources such as *Campylobacter jejuni* and enterohaemorrhagic, Escherichia coli. Several bacterial pathogens, such as *Legionella* species, *Aeromonas* species, *Pseudomonas aeruginosa* and *Mycobacterium avium* have a natural reservoir in the aquatic environment and soil (Leclerc *et al*., 2003).

More than 15 different groups of viruses encompassing more than 140 distinct types can be found in the human gut. These enteric viruses are excreted by patients as well as asymptomatic carriers and find their way into sewage. The most prevalent enteric protozoa associated with waterborne diseases include *Giardia lamblia* and *Cryptosporidium parvum*. In addition, protozoa like *Cyclospora*, *Isospora* and many *Microsporidian* species are emerging as opportunistic pathogens and may have water- borne routes of transmission. Like viruses, these protozoa cannot multiply but do survive in contaminated water. The risk

to human health from water-based infections in natural watershed systems is most easily determined by assessing the concentrations of certain indicator bacteria in the water such as fecal coliforms and *Streptococci* (Monzer *et al*., 2005).

2.7 Waterborne diseases

Many infectious diseases are associated with faecally contaminated water and are a major cause of morbidity and mortality worldwide. Waterborne diseases are caused by enteric pathogens such as bacteria, viruses and parasites (Table 1) that are transmitted by the faecal oral route. Waterborne spread of infection by these pathogenic microorganisms depends on several factors such as: the survival of these microorganisms in the water environment, the infectious of microorganisms required to cause a disease in susceptible individuals, the microbiological and physico-chemical quality of the water, the presence or absence of water treatment and the season of the year (Leclerc *et al*., 2002).Waterborne diseases are caused by the drinking of water polluted by pathogen bearing urine or feces. They include typhoid, bacillary and amoebic dysentery, cholera and other diarrheal diseases. Water-based diseases result from parasites that live in water-based organisms. The water-based organisms serve as intermediate contacts for these parasites. (Bradley. 1977).

Table 1: Waterborne diseases and their causing agents

Agents	Diseases	Microbial Agent	Disease Symptoms
Bacteria	Gastroenteritis	*Campylobacter* spp	Fever, abdominal pain, diarrhea
	Bacillary dysentery	*Shigella* spp	Fever, diarrhea, bloody stool
	Cholera	*Vibrio cholerae*	Severe, Watery diarrhea, vomiting, occasional muscle cramps
	Typhoid fever	*Salmonella typhi*	Fever, headache, constipation, appetite loss, nausea, diarrhea, vomiting, appearance of an abdominal rash
	Salmonellosis	*Salmonella* spp	Gastroenteritis, fever and rapid blood-poisoning
	Haemolyticuremic syndrome	*E. coli O157:H7*	Bloody diarrhea and stomach pain
	Giardiasis	*Giardia lamblia*	abdominal discomfort
Parasites	Amoebiasis	*Entamoebahistolytica*	Abdominal discomfort, fatigue, diarrhea, flatulence, weight loss
	Taeniasis	Tapeworms of the *GenusTaenia*	Intestinal disturbances, neurologic manifestations, loss of weight loss.
	Ascariasis	*Ascarislumbricoides*	Mostly, disease is asymptomatic or accompanied by inflammation, fever, and diarrhea. Severe cases involve syndrome in lungs, nausea, vomiting, and malnutrition.
	Fasciolopsiasis	*Fasciolopsisbuski*	GIT disturbance, diarrhea, liver enlargement, cholangitis, cholecystitis.
	Toxoplasmosis	*Toxoplasma gondii*	"Flu" with swollen lymph glands or muscle aches, damage to the brain, eyes, or other organs
Virus	Infectioushepatitis Viral	*Hepatitis A*	Fever chills, abdominal discomfort, dark urine
	Gastroenteritis	*Norwalk,rotavirus*	Fever, headache, gastrointestinal Discomfort, vomiting, diarrhea
	Toxoplasmosis	*Toxoplasma gondii*	"Flu" with swollen lymph glands or muscle aches, damage to the brain, eyes

Sources: UNICEF, 2008

Most common waterborne diseases and can cause severe epidemics (UNICEF, 2008) discuss in detail in the Following sections:

2.7.1 Cholera

Cholera is an acute infectious disease caused by a bacterium *Vibrio cholerae*, which can infect humans mainly via water or food contaminated with faeces. However, Cholera outbreaks are often associated with unsafe water supplies and inadequate hygiene (Cabral, 2010). *Vibrio cholerae* is a Gram negative bacteria which can grow at 40^{o}C at pH 9-10.*Vibrio cholerae* survive in the cultivable state in water, aquatic and marine organisms for a considerable period of time (Wallace, 2008). It is very common in seas, rivers and estuarine associated with blue-green algae, living free or on the surfaces and in the intestinal contents of marine animals (Farmer *et al*., 2005).Under normal circumstances due to the sensitivity of *Vibrio cholerae* to low pH environments. When *Vibrio cholerae* face adverse environmental conditions and they reduce cell size, become coccoid and enter a dormant stage inside exopolysaccharide biofilms. Cells display a certain metabolism, but are not able to grow in vitro. Cells in this viable but non-culturable state retain viability as well as the potential for pathogenicity for significant periods of time.

Since the presence of non-toxigenic strains is common in aquatic milieu, especially in estuaries, if a horizontal transfer of cholera exotoxin producing genes occurs between toxigenic and non-toxigenic strains, the number of toxigenic cells in the environment can rise rapidly and pronouncedly. The episodic nature and the sudden appearance of violent cholera outbreaks, followed by a rapid slowing down, are probably related to these phenomena (Cabral, 2010).The disease is characterized by acute and intense diarrhoea. Cholera symptoms include thirst, muscular pains, general weakness, and signs of oliguria, hypovolemia, hemoconcentration, followed by anuria. Patients feel lethargic and blood potassium drops to very low levels. Finally, circulatory collapse and dehydration with cyanosis occurs (Wallace, 2008).

Lower socioeconomic groups have a higher incidence of cholera for a variety of reasons including occupational exposure, unsanitary conditions in low-income housing areas, primarily reflected in inadequate sewage disposal and contaminated water sources and high population density, increasing the risk of introduction of *Vibrio cholerae* and possibly enhancing the growth of organism after it has been introduced (Wallace, 2008).In the absence of treatment, the disease has a 60% death-rate, the patient dying within few hours of first showing symptoms, although with suitable treatment the death rate can be reduced to less than 1% (Gray, 2008).

2.7.2 Amebiasis

The Causative agent of Amebiasis is *Entamoeba histolytica*, it is worldwide but most common in the tropics and sub-tropics. Prevalent in areas with poor sanitation, in mental institutions and homosexuals. Amoebiasis is mostly a disease of young people and rare below 5 years of age, especially below 2 years.

Mode of transmission: Fecal-oral transmission by ingestion of food or water contaminated by feces containing the cyst. Acute amoebic dysentery poses limited danger.

Pathogenecity astrophozoite attaches to colonic mucosa and epithelial cells and cause ulceration of the mucosa of cecum, sigmoid colon and rectum. Rarely, intestinal infection results in the formation of mass lesion. Sometimes troplozoites invade veins to reach the liver and cause liver abscess.

Symptoms: Intestinal infection may be asymptomatic; intermittent diarrhoea with abdominal pain; amoebic colitis presenting as bloody diarrhoea; and a fulminant colitis with significant mortality in the malnourished, pregnant, immune suppressed.

Prevention method: Avoidance of faecal contamination of water supplies, combined with adequate water treatment (e.g. filtration), good personal, and toilet and food hygiene (WHO/UNICEF,2010).

2.7.3 Giardiasis

The causative agent of giardasis is *Gardia lamblia*. The pathogen occurs worldwide affecting more children than adults. According to surveys conducted in Ethiopia, it accounts for a prevalence of between 2 and 11 percent as recorded in some highland communities and nomadic pastoralists. Urban areas like Addis Ababa are equally affected with a prevalence of 9% recorded in some children.

Pathogencity: The mechanism by which Giardia causes alteration in small bowel function is largely unknown. Infection is limited to small intestine and biliary tract.

Symptoms: About a quarter of acute infections are asymptomatic excretory. Symptomatic diarrhea may be accompanied by malaise, flatulence, foul-smelling greasy stools, abdominal cramps, bloating, nausea and anorexia. **Prevention method:** Adequate treatment of water supplies, adequate control of infection and food hygiene practices in institutions, especially those dealing with children. Good personal hygiene and hand washing before food and following toilet use sanitary disposal of feces Protection of public water supply from contamination of feces Safe water supply (UNICEF, 2013).

2.7.4. Typhoid fever

The causative agent of typhoid fever is: *Salmonella typhi*. It occurs worldwide, particularly in poor socio-economic areas. Annual incidence is estimated at about 17 million cases with approximately 600,000 deaths worldwide. In endemic areas the disease is most common in preschool and school aged children

(5-19 years of age). Typhoid fever remains a serious public health problem in Africa as sub-Saharan Africa has the second highest incidence after Southeast Asia.

Mode of transmission: By water and food contaminated by feces and urine of patients and carriers. **Pathogonecity** of these diseases as the organism, *Salmonella typhi*, enters the gastro intestinal tract and invades the mucosa of colon and ileum. After intracellular multiplication in the mucosal cells bacteremia occur Tissue invasion causes inflammation in the intestine and gall bladder. Hematogenous dissemination occurs to spleen, liver and bone marrow**.**

Symptoms: Headache, malaise and chills, constipation, diarrhea and abdominal tenderness Intestinal perforation occurs but rarely mild hepatomegaly can occur. Skin rash (rose spots) may appear over the chest and abdomen. Even after infection resolves, asymptomatic carriers may continue to transmit disease through feces. This is especially true of children (Wallace, 2008).

2.7.5 Bacillary dysentery (Shigellosis)

Bacillary dysentery, most easily defined as bloody diarrhea, is an infectious disease of the Intestinal tract caused by bacteria of the genus *Shigella*. The genus *Shigella* is spread through water or food contaminated by faeces. Shigella infection is typically via ingestion (faeco–oral contamination); depending on age and condition of the host, as few as 10 to 200 bacterial organisms can be enough to cause an infection. The incubation period of shigellosis ranges from less than 12 hours to 6 days. Dysentery is characterized by abdominal pain, diarrhoea with bloody mucous stool which is moved several times with a small amount each time, tenemus, burning sensation at the anus, scanty dark urine, chill and fever, yellow and greasy coating of the tongue and rapid pulse rates (Cabral, 2010).

Dysentery is initially managed by oral rehydration therapy. If this treatment cannot be adequately maintained, hospital admission may be required for intravenous fluid replacement. It can usually be treated with antibiotics, such as ampicillin, trimethoprim/sulfamethoxazole (also known as Bactrim or Septra), nalidixic acid and the fluoroquinolone, ciprofloxacin. *Shigella* infections are less common in communities with access to potable water and good sanitation. Hand washing practices have proven to be an effective control measure even in area with poor sanitation (Wallace, 2008).

2.8 The global burden of waterborne diseases

Exposure to contaminated water contributes significantly to waterborne diseases especially diarrhoeal diseases worldwide. The WHO (2005) estimates that approximately 4 billion cases of diarrhoea each year cause at least 1.8 million deaths, 90% of which are children under the age of five. About 88% of these deaths are attributable to the use of either untreated or inadequately treated ground surface waters, inadequate sanitation and poor hygiene (WHO, 2005; UNICEF, 2008). Waterborne diseases are distributed worldwide; however, the burden is high in developing countries where a large part of the population does not have access to safe drinking water (WHO, 2003).Since then, drinking water-related outbreaks of pathogenic *E. coli* have occurred throughout the world (Cabral, 2010). There were 27,000 reported outbreaks of *Campylobacter* enteritis in the UK during 1987, rising to over 30,000 in 1990 causing acute diarrhoea and it is now thought that *Campylobacter* is the major cause of gastroenteritis in Europe, making it more of a threat than *Salmonella* (Gray, 2008).

A *Cryptosporidium* outbreak in Georgia in 1987 affected 13,000 people. The most important outbreak of Cryptosporidiosis occurred in the USA during April 1993 where 440,000 people became infected and of the 4,400 that were hospitalized, 50 people died, making *Cryptosporidium* the most serious waterborne disease in developed countries. In sub-Saharan Africa, diarrhoeal diseases are a leading cause of death in children under the age of five. It is estimated that each child has five episodes of diarrhoea per year and that 800,000 of those children will die from diarrhoea and associated dehydration. Since 1991, dysentery epidemics have occurred in eight countries in Africa in Angola, Burundi, Malawi, Mozambique, Rwanda, Tanzania, Democratic Republic of Congo and Zambia. Over the past 20 years, trends of cholera have shifted from a high incidence in the Americas during the early 1990s towards high incidence in Africa today, with a few cases reported from Asia. Globally, cholera incidence has increased steadily since the beginning of the millennium (Gray, 2008).

Cholera outbreaks persist in sub-Saharan Africa, and this disease continues to pose a public health problem among developing world populations without access to adequate water and sanitation resources. In 2007, various countries around the world reported 178, 677 cases of cholera and 4033 cholera deaths to the WHO. About 62% of those cases and 56.7% of deaths were reported from the WHO African Region alone (Cabral, 2010).

2.9 Source of water supply

In many developing countries, potable water is collected from communal sources which are either exposed (e.g. unprotected wells, unprotected springs, and rivers) or improved (e.g. protected wells, boreholes and public standpipes) (WHO/UNICEF, 2000). The Primary source of human pathogens in water sources has been from human waste. Animal waste also carries pathogens that affect people as well as other animals. Discharge of domestic wastes into surface waters allows pathogenic bacteria to be dispersed downstream (Goel *et al*., 2004).Several studies carried out in developing countries investigated the microbiological quality of these improved and unimproved water sources and the results obtained were different depending on the water source. The results of a study carried out in Saudi Arabia, indicated that water collected from traditional sources (wells) showed increases in most of the investigated bacteriological parameters, followed by surface water and bottled or desalinated water. Coliforms were not detected in any samples taken from bottled water, but it was detected in samples taken from desalinated, surface, and well water; of 12.9%, 80%, and 100%, respectively (Alotaibi, 2009).

2.10 Point- of- use water management in the households

Household-level approaches to drinking water treatment and safe storage are also commonly referred to as managing water at the "point-of-use" (POU) (WHO, 2007). POU drinking water treatment and safe storage options can reduce risks of disease until the longer-term goal of universal access to piped, treated water is achieved. By preventing disease, household water treatment and storage practices can contribute to poverty alleviation and development (UNICEF, 2008). Their widespread use, in conjunction with hygiene education and latrine provision, has the potential to save millions of lives until the infrastructure to reliably deliver safe water to the greater population has been created. Household water treatment and safe storage (HWTS) interventions can lead to dramatic improvements in drinking water quality and reductions in diarrhoeal disease making an immediate difference to the lives of those who rely on water from polluted rivers, lakes and, in some cases, unsafe wells or piped water supplies (Gundry *et al*.,2004;UNICEF, 2008; WHO, 2010).

2.11 Households level water treatments

Household's treatment is an option increasingly adopted by householders themselves. Properly protected water sources, well managed municipal and community treatment systems should result in safe water for consumers. However, this is often hard to achieve, especially in rural and poor urban areas in developing countries. Leaky and sporadically functioning distribution systems allow recontamination to occur, as do poor hygiene, water transport and storage practices. In some cases, in many developing countries, safe

water is simply not available and people rely on contaminated water sources, where the only alternative is to treat water in the home (UNICEF, 2008).Numerous studies have shown that improving the microbiological quality of household water by on-site or point-of-use treatment and safe storage in improved vessels reduces diarrhoeal and other waterborne diseases in communities and households of developing as well as developed countries. Reductions in household diarrhoeal diseases of 6-90% have been observed, depending on the technology and the exposed population and local conditions (Sobsey, 2002; Montgomery and Elimelech, 2007).

Several technologies to improve the microbial quality of household water and reduce waterborne disease have been developed and include a number of physical and chemical treatment methods (Sobsey, 2002; WHO, 2007). The physical methods, include boiling, heating (fuel and solar), settling, filtering, exposing to the UV radiation in sunlight, and UV disinfection with lamps. The chemical methods include coagulation-flocculation and precipitation, adsorption, ion exchange and chemical disinfection with germicidal agents (primarily chlorine). The advantages and disadvantages with regards to the use of these household treatments methods used in developing countries are discussed in the following sections.

2.11.1 Boiling

Boiling is widely used since it is easy to use and effective in destroying bacteria, viruses and protozoa in all types of water. However, the collection of firewood is time consuming, could lead to deforestation and is an expensive method for general use. A further concern is that water is often transferred to storage containers for cooling and thus can become re-contaminated (Sobsey, 2002).

2.11.2 Plain sedimentation or settling

It is used for very turbid water. The quality of water sometimes can be improved by holding or storing it undisturbed and without mixing long enough for larger particles together with large microbes to settle out by gravity. The settled water can then be carefully removed and recovered by decanting, ladling or other gentle methods that do not disturb the sediment particles. Sedimentation often is effective in reducing water turbidity. The disadvantage of sedimentation is that fine clays and pathogenic microorganisms such as viruses and bacteria do not settle (Sobsey, 2002). It is widely used because it is ultra-low cost or free and relatively simple to implement. However, because at least 6 hours of exposure to bright sunlight is required to de-activate pathogens, SODIS is not applicable in some climates and during rainy seasons (Lantagne *et al*., 2006; UNICEF, 2008).

2.11.3 Filtration

It is a widely used method that removes particles and some microorganisms from water (Potgieter,2007). A variety of filter media and filtration processes are available for household or point-of-use treatment of water. However, the removal of microorganisms, the cost and availability of the filtration media and methods in developing countries vary widely and often depend on local factors (Sobsey, 2002). Filtration through porous granular media, typically sand or successive layers of anthracite coal and sand, is the most widely used physical method for water treatment at the community level, and it has been used extensively for on-site treatment of both community and household water. The granular type of media filters for household bucket filters, drum or barrel filters are the most effective at reducing turbidity and enteric bacteria by 90%, larger parasites by 99% and enteric viruses by 50% to 90%, Slow sand filters, fibre, fabric and membrane filters, porous ceramic filters and diatomaceous earth filters are alternative filters that have been tested and used for household water treatment in developing countries (Sobsey, 2002).

2.11.4 Household chlorination

Chlorine is the most widely used and the most affordable of the drinking water disinfectants (Sobsey, 2002; Lantagne *et al*., 2006). The source of chlorine can be sodium hypochlorite. The sodium hypochlorite solution is packaged in a bottle with directions instructing users to add one full bottle cap of the solution to clear water in a standard-sized storage container of 20 l; agitate; and wait 30 min before drinking (Lantagne *et al*., 2006). At concentrations used in household water treatment and safe storage programs with low turbidity water, chlorine effectively inactivates bacteria and some viruses and thereby prevents waterborne diseases such as cholera, typhoid and dysentery (WCC, 2008).

2.12 Water quality and associated risks

Water quality is a technical term that is based upon the characteristics of water in relation to guideline values of what is suitable for human consumption and for all usual domestic purposes including personal hygiene. Components of water quality include microbial or biological, chemical and physical aspects (EPA, 1999). Drinking water starts its journey within catchments, and is subsequently purified at treatment plants and delivered through distribution systems. Before delivers to distribution system it must meet the highest quality standards. To meet these quality standards, subsequent treatment processes must be done at place of treatment (Solomon, 2011). Drinking water quality has a strong impact on people's health because water is a vehicle for many pathogenic microorganisms and physic-chemical agents that causes waterborne diseases (Haworth, 1996).

2.13 Ethiopian standards of drinking water quality

Water is essential to sustain life, and a satisfactory adequate, safe and accessible supply must be available to all. Improving access to safe drinking-water can result in tangible benefits to health. Every effort should be made to achieve drinking-water that is as safe as practicable. Safe drinking- water, as defined by the Guidelines (Table 2), does not represent any significant risk to health over a lifetime of consumption, including different sensitivities that may occur between life stages. In other direction, the nature and form of drinking-water standards may vary among countries and regions and there is no single approach that is universally applicable. In the development and implementation of standards, it is essential to consider the current or planned legislation relating to water, health and local government and the capacity of regulators in the country. Additionally, approaches that may work in one country or region will not necessarily transfer to other countries or regions (WHO, 2011).

Table 2: WHO and Ethiopia guideline value of drinking water

S.N	Parameter	WHO (2011) Standards	Ethiopia (2004) Standards
1	pH	6.5- 8	6.5 - 8
2	Turbidly(NTU)	< 5 at disinfection point	< 5
3	Freechorine residual(mg/L)	0.2 - 0.5 at distribution point	0.1 – 0.2
4	Fecalcoliform (CFU/100mL	0	0
5	Total Coliform(CFU/100mL	-	0
6	Nitrate(mg/L)	0.5	0.5
7	Ammonia(mg/L	-	0.5

Source:*http://www.lenntech.com*.

2.14 Health risk association with water

Water is a basic necessity for life. Unfortunately, not all water helps human to survive. Water from contaminated sources causes numerous diseases and untimely death. The fact that a human needs water and cannot live without it forces him to use it even for drinking purposes, from any source, whether pure or contaminated (Zeyede and Tesfaye, 2004). Usage of quality deteriorated water may be a cause for the existence of waterborne, water- washed, water -based and water related diseases.These are *cholera, bacillary dysentery, viral hepatitis A, shigellosis, typhoid fever,cryptosporidiasis, giardiasis (*WHO, 2001). Generally, waterborne disease outbreaks usually involve, source contamination and the breakdown of the treatment systems, contamination of the distribution systems and the use of untreated water .Water-associated disease can be defined as a disease in relation to water supply and sanitation. Several

infections enteric or intestinal diseases of man are transmitted through water contamination by fecal matter. Pathogens excreted in water by an infected person include all major categories such as bacteria, viruses, protozoa and parasitic worms. In this category water acts as a passive vehicle for the infectious agent (WHO, 2004). Some waterborne diseases and causing microorganisms are presented (Table 3).

Table 3: Waterborne diseases causing agents and their sources

Diseases	Diseases causing organisms	Microbial types	Sources
Typhoid	*Salmonellae typha*	Bacteria	Human feces
Cholera	*Vibro-cholera*	Bacteria	Human feces
Amoebic dysentery	*Entamoebahistolitica*	Protozoa	Human feces
Giardiasis	*Giardia-lamblia*	Protozoa	Human or animal feces

Sources: Public Health Guide for Emergencies (2000)

2.15 Link between diseases and environment

Unlike genetic diseases, which individuals are predisposed to, acquiring water, sanitation and hygiene related diseases are controllable and preventable. The spread of these diseases depends on environmental conditions and behavior in the households and community. The majority of these preventive measures are related to environmental conditions appropriate shelter and site planning, clean water, good sanitation, vector control, personal protection (such as insecticide-treated nets), personal hygiene and health promotion. These measures address conditions in the environment, known as ‘risk factors’ because they can cause disease. It is important to understand the relationship between disease and environmental risk factors because interventions must target risk factors properly. Sanitary survey of a water supply system is the complete, extremely careful and detailed investigation of the entire water supply system, from source to end users, in order to detect the presence of actual or potential sources of contamination. (Public Health Guide for Emergencies, 2000).

3. MATERIALS AND METHODS

3.1 Description of the study area

Ude is a rural town located in Oromial Regional State, East Shoa Zone, Ada'a district, 7 km far from Bishofitu city (Figure 3.1) and 56 km southeast of Addis Ababa. It has an elevation of 1,999 meters above sea level, at latitude of $8^0$45N and longitude of $38^0$58'E (Figure 3.1). It was officially declared as a rural town in 2003 (Ada'a Administrative Offices, Unpublished data).The average minimum and maximum annual temperature is 6^0C and 36^0C respectively. The town is bounded by in east Gobesay, in west Dhankaka, in south Qumbursa kebele administration and in north by Bishoftu city.

The total population of the town is 5379 and the number of households is 815. There are 2 health centers, one public toilet and two hands –dug well water. The location map of study sites (Figure 1).

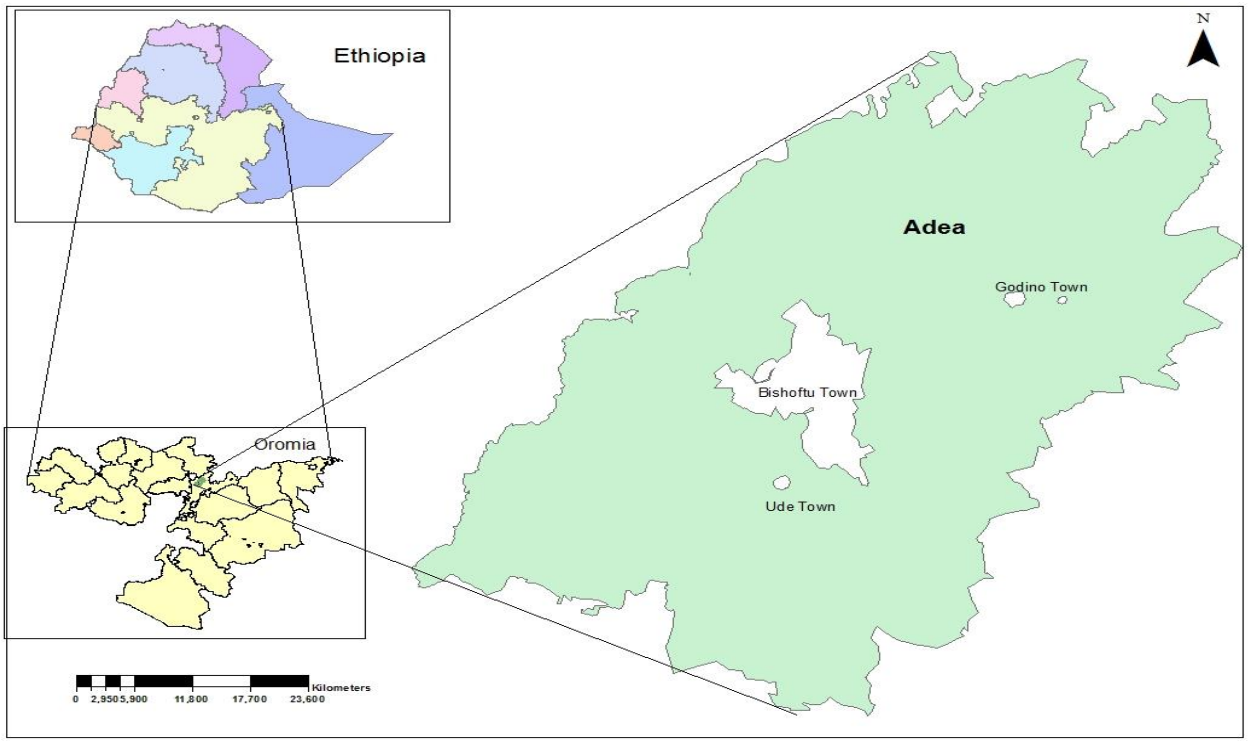

Figure 1: Map of Adea district (Source: CSA, 2015)

3.2 Study design and sampling methods

The descriptive studies were conducted on Ude rural town households. First, the study area was divided into cluster. These clusters had Kebele 01, Seferachare, Dhakaka and Asepalt. At the second stage, some houses were identified at random within each cluster. Out of these houses, households was sampled and given household identification numbers in the third stage and were listed. From the list the first house was

selected by randamly and the rest was selected by interval of 3 from January and end up at mid February. During this 15 household units were covered within one day. Household head means the person who plays the main role in the decision-making process of a family were selected to answer the questionnaire and in absence of the household head, the second important adult member of the family was selected. In doing so, the study objectives were clearly explained to the households and each household was assured that the information provided would be kept confidential. Two hundred eight-six households were select based on the following formula. The sample size would be determined using the single population proportion (Cochran, 1977) formula.

$$n = \frac{N*Z^2*P*Q}{d^2*(N-1) + Z^2*P*Q}$$

Where,

n=sample household

N=total number of house hold

P= proportion (50%)

Q=1-P

Z=95% confidence interval (1.96)

d = Degree of accuracy required (sampling

Error) is 5% that is, d = 0.05

$$\mathbf{n} = \frac{815*(1.96)^2*0.5*0.5}{0.05^2*(815-1) + 1.96^2*0.5*0.5} = 260 \text{ households}$$

And we assumed non response rate of 10 %, therefore the total sample size were 286

Of these total respondents, 72 were from kebele 01, 97 from Dhankaka kebele, 50 from Asepalt, and 67 were selected from seferachare kebele administration based on the proportion of the households.

3.3 Method of data collection

The quantitative and qualitative data were collected from January 2017 to February 2017 Primary data and secondary data.

Primary data were gathered through questionnaires, Interviews and direct observation.

Questionnaires: questionnaires which focus mainly on water sources used, Toilet facility and use of water treatment before use, focused on information concerning with water and environmental hygiene

and sanitation practices and collected information on the participant's knowledge of waterborne diseases, their causes and prevention practices at the household level and on the awareness of waterborne diseases (Appendix A). The questionnaire comprised 15 questions translated in to Afan oromo language and were administered to the respondents by reading the question to the respondents by trained 16 data collectors and the researcher supervised the whole process of data collection. The questionnaire comprised 15 questions.

Interviews: Interview were made with health extension workers which mainly focused on sources of water, Treatment methods for drinking water, wastage storage practices, availability of toilets and knowledge regarding causes of diarrhea (Appendix B). Direct observation: observation was done from January 2017 to April 2017, through observational checklists. (Appendix C).

Secondary data were gathered through reviewing both published and unpublished relevant materials town Ude health centers records from January 2017 to April 2017 unpublished theses regarding the prevalence of waterborne diseases. All information was gathered using the checklist (Appendix D).

3.4 Methods of data analysis

Data gathered through questionnaires, interviews and observation were analyzed using descriptive statistics. Results were presented using frequency distributions, percentages, tables and Figure. The results were analyzed using statistical software SPSS version 20 and Chi square used to analyze the association of use of water treatment, toilet facility and water sources with prevalence of water borne disease.

3.5 Quality and ethical consideration

Oromia health bureau and Ada'a Woreda Health Centers were willing to assist the researcher on data collection and in providing necessary data documented in the health centers that provided detail information about patient which explain on the overall objective of the study. Information provided by interviewees was not be transferred to a third party or was not be used for any other purpose only for purpose of research.

4. RESULTS

4.1. General data of respondents

Information of respondents is shown in Table 4, the proportion of female was fair (44.4%). Most of the respondents (42.3 %) were between the ages of 31- 40 and had completed secondary school they had their own perception to understand the status of their water source service status and most of them (85.6 %) were farmers.

Table 4: General data of respondents (n = 286)

	Characteristics	Frequencies (n)	Percentages (%)
1	**Sex**		
	Male	159	55.5
	Female	127	44.4
2	**Age**		
	20-30	56	19.5
	31-40	121	42.3
	41 - 50	57	19.9
	>50	52	18.1
3	**Marital status**		
	Married	267	93.3
	Single	19	6.6
4	**Occupation**		
	Farmer	245	85.6
	Housewife	13	4.5
	Civil servant	28	9.7
5	**Level of education**		
	1 - 4	3	1
	5-8	23	8
	9-10	220	76.9
	11-12	12	4.1
	Collage	4	1.3
	University complete	24	8.3

4.2. Residents' sources of water, practices of water treatment and water contaminants

The study showed that there is no pipe water supplied by the government and most (88.4 %) of the residents used well water. Most (77.9 %) used this water for drinking without treating it, but some residents used traditional water treatment like filter with cloth (Table 5).Ude Health Extension workers reported that most households used treat water during rainy season as well water can easily be contaminated animal wastes, agricultural products and human feces by water entering to the well.

Table 5: Residents sources of water, practices of use of water treatment and sources of water contaminates in Ude town (n = 286)

	Characteristics	Frequency (n)	Percentage (%)
1	Well water	253	88.4
	Rain water/collection	33	11.5
	Pipe water	-	-
	Surface water	-	-
2	Practices of water treatment before drinking		
	Yes	63	22
	No	223	77.9
3	Activity around water sources		
	Irrigation	150	52.4
	Construction	120	41.9
	Others	10	2.4
4	Main contaminants found around water sources		
	Animal waste	115	40.2
	Agricultural products	92	32.1
	Human feces/toilet	29	10
	Others	50	17.4

4.3 Observation of site of well water sources

Assessment of relevant sanitary conditions and construction of each water source during sample collection indicated that 33.2% (n = 256) hand-dug wells had no habit to cover it. Some were poorly constructed and situated in a bushy environment while some were very close to where the households house and situated close to dump-site (Figure 2).

Figure 2: Sample household well water sources (photo by Zinash Dessie in 2017)

4.4 Water treatments

Most (58 %) of the participants reported that they used water without treating while the rest treated water using different method like boiling (16.7%) and filtering (29.9%) (Table 6)

Table 6: Residents use of water treatments (n = 286)

	Characteristics	**Frequency(n)**	**Percentage (%)**
1	**Resident not used water treatments**	166	58
2	**Resident used water treatments**	120	41.9
	Boiling	48	16.7
	Add agar/chlorine	12	4.1
	Filter it through cloths	57	29.9
	Use water filter machine/sand	3	1

4.5 Types of pit latrine facility

The result showed that 88.4% of residents had pit latrine and of these only 5.2 % of pit latrine had water facility by using small material (jarecane) .The remaining had no water facility (Table 7).

Table 7: Residents pit latrine/toilet facility (n = 286)

	Characteristics	Frequency (n)	Percentage (%)
1	**Presence of toilet/ pit latrine**		
	Yes	253	88.4
	No	33	11.5
2	**Water facility in the toilet/ pit latrine**		
	Yes	15	5.2
	No	271	94.7

From personal observation most of the sampled houses had private pit latrine were constructing from wood, plastic, Chipwood and grass and had no water facility and were not clean (Figure 3).

Figure 3: Types of household pit latrine (photo by Zinash Dessie in 2017)

4.6 Environmental sanitation condition

From the direct observation of the study area 41.9% (n=121) of the households did not use sufficiently large waste collecting sacks. The wastes throw everywhere. Solid wastes like food waste, paper, rubbish, ashes, plastic and improper management of liquid wastes in the study area (Figure 4). During the interviews, health extension workers reported education had been given to the community once every months(on the 29th of each months) by the worker on sanitation, water treatments, use of toilet, Cause of diseases but this is not enough.

During dry season both solid and liquid wastes collect together. In during rainy season the wastes distributed everywhere and environment highly polluted by different factors such as plastic wastage, animal wastes, agricultural. Direct observation of sanitation practice was undertaken to help the researcher obtain first hand information about the sanitation behavior of the community that has become so much for the presence or absence of sanitation practices on an observational guide (Appendix B).

Figure 4: Disposal of solid wastes in study area (Photo by Zinash Dessie in 2017)

4.7 Waterborne diseases and their prevalence

Data obtained from health center showed that the total patients (315) who were diagnosed of waterborne diseases (59.0%) of them contracted typhoid fever. Followed by ameboisis (27.3 %),giardiasis 9.5 %, cholera 3.2% and others(taeniasis, bacillary Dysentery) contributing to few diagnosis result of 0.95 % (Table 8).

Table 8: Prevalence's of waterborne diseases

S,N	Waterborne diseases	Frequency (n)	Percentage (%)
1	Typhoid fever	186	59.0
2	Amoeboisies	86	27.3
3	Giardiasis	30	9.5
4	Cholera	10	3.1
5	Others(Taeniasis,Bacillary Dysentery).	3	0.95

Data from residents showed that most (43.3 %) residents that experiences by waterborne diseases during rainy season (Table 9).

Table 9: Prevalence's of waterborne diseases (n = 286)

	Waterborne disease	Frequency (n)	Percentage (%)
1	Experience of any waterborne diseases		
	Yes	95	33.2
	No	191	66.7
2	Season in which waterborne disease was experienced		
	Rainy season	125	43.7
	Dry season	57	19.9
	Undecided	72	25

4.8 Chi-square test for association between water sources, toilet facility and sanitation condition of community with waterborne diseases

Pearson's Chi-square test showed different statistical significant associations between the dependent variables waterborne diseases and independent variables as water sources, water treatment, toilet facility, presences of dump site and water facility in toilet.

4.8.1 Association between drinking water sources and water treatment with waterborne diseases

The study shows that 47.9% of people affected by diarrhea cases diseases in this year use well water source for drinking, the rest who maintain their basic water access that getting from collected water sources (Table 10). The Chi -square test results shown that a highly significant relationship with waterborne diseases (P-value of 0.000). The water treatment mechanism also shows a significant relationship with waterborne disease (p- value of 0.001).

Table 10: Association between water sources with waterborne diseases (n = 286)

		Community affected by water borne diseases			Pearson's Chi-square test		
					X^2	df	P- value
What are sources of drinking water used by households?	open well water	137(47.9%)	115(40.2%)	252	25.951[a]	1	.000
	Rain water collection	34(11.8%)	0	34			
Total		171	115	286			
Do you treat your drinking water	yes	89 (31.1%)	36 (12.5%)	125	12.024[a]	1	0.001
	no	82 (28.67%)	79 (27.6%)	161			
Total		171	115	286			

NB: a indicated that significant association at 5% level.

4.8.2 Association between toilet facilities and dump site with waterborne diseases

The result of the study showed that most respondent's toilet had not water facility and high risk to affect by waterborne diseases (Table 11).The Chi square results shown no significantly associated with waterborne diseases (p value 0.37). Under environmental sanitation condition people who had not dump site more affected by diarrheal diseases than had dump sites which significantly associated with waterborne diseases (p value 0.000.). About 37% of community had toilet facility and they were not affected by water borne diseases which not significantly associated with waterborne diseases (P-value= 0.5).

Table 11: Association between toilet facilities and dump site with waterborne diseases (n = 286)

		Community affected by water borne diseases		Total	Pearson's Chi-square test		
		yes	N0		X^2	df	P- value
Do you have toilet facility	yes	106 (37%)	66 (23%)	172	1.381	1	0.5
	no	65 (22.7%)	49 (17.1%)	114			
Total		171	115	286			
Is there water facility in the toilet	yes	53 (18.5%)	30 (10.4%)	83	0.804	1	0.37
	no	118 (41.2%)	85(29.7%)	203			
Total		171	115	286			
Have you dump site around the houses?	yes	91 (31.8%)	0	91	89.758	1	.000
	no	80 (27.9%)	115(40.2%)	195			
Total		171	115	286			

4.9 Awareness of respondents on waterborne diseases

Results of participant's awareness about causes and prevention of waterborne diseases are shown in Table 12. About 12.9% of the respondents identified contaminated water as the possible cause while 53.8% thought it was caused by use contaminated water for domestic purpose. Other 33.2% of respondents not wash their hand after and before eating food (Table 12).When asked about prevention method of diseases, 43% of the respondents indicated that they treated their drinking water and 36% washed their hands before eating food to prevent it, the rest were keeping water in clean and closed continuers and used clean toilet.

Table 12: Awareness of respondents on waterborne diseases (n = 286)

characteristics	Frequency(n)	Percentage (%)
Respondents knowledge of causes of waterborne diseases		
Drinking contaminated water	137	12.9
Use of contaminated water for domestic purpose	155	53.8
Did not wash your hand before and after eating food	95	33.2
Measurements that respondents take to prevent waterborne diseases		
Drink treated water	123	43
Keep water in clean and closed container	69	24.1
Wash hands before eating food	103	36
Use clean toilet	117	40.9

5. DISCUSSION

This study focused on the assessment of water sanitation and prevalence of waterborne diseases in Ude rural town. According to a report by WHO/UNICEF, (2008) on global statistics, water and hygiene, water supply, sanitation and diarrhoea are closely related to Poor hygiene, inadequate quantities and quality of drinking water and lack of sanitation facilities cause millions of the world's poorest people to die from preventable diseases each year which women and children are the main victims. In the study area the proportion of females is 44% that is important because of most rural area supply of portable water and sanitation practices are more responsibility given to female that gave information.

About 42% of the respondents were between the ages of 31-40 as the age of the head of the household increased, there was improvement in the sanitation conditions of the household and had completed secondary school that educated heads had better sanitation conditions than that of households with illiterate heads. This implies that, sanitation intervention program cannot progress without adequate formal education. And also most of household are married, there is responsibility sharing sanitation condition to reduce prevalence of waterborne diseases. The link between poor water sanitation and diarrhoea include contaminated water that is consumed and may result in waterborne diseases including viral hepatitis, typhoid, cholera, dysentery and giardia.

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The first priority for interventions to improve access to water supplies is to ensure that at least basic access is achieved and safe water and sanitation facilities as well as knowledge of proper hygiene practices can reduce the risk of illness and death from waterborne diseases (CDC, 2010) but in study area most of residents had no pipe water supplied by the government and most (88.4 %) of the residents used well water without treating. Only 22 % households used water treatments during rainy season because of polluted water entering the wells otherwise did not use water treatment. Inadequate or no treatment of drinking water remains a problem in rural communities. More than half of the study households (58%) did not use any treatment before consuming their water. Several studies have reported that inadequate water supply could result in an increase in numbers of some microorganisms such as heterotrophic bacteria and total coliform over time (Sobsey, 2002) and as reported by International Fund for Agricultural Development (IFAD, 2015) that households in the rural area have very little safe drinking water, sanitation, this might be dangerous for people vulnerable to water borne diseases.

UNICEF/WHO (2009) recommended that the use of both physical and chemical water treatment methods in order to manage diarrhoeal diseases, thus reducing the burden of prevalence of waterborne diseases. But in the study few people treated water by chlorine, boiling and sedimentation as treatment measures. Others used traditional techniques like smoking and washing the container with a special wood, plant leaves and sand which have pleasant smell and odor. But these habits had not important for preventing prevalence of waterborne diseases and easily vulnerable to water related diseases. So, the communities had no access to clean water and are highly vulnerable to catch waterborne and water-related diseases, such as thyphoid, giardia, amoeba, cholera, schistosomiasis diseases.

All types of water sources may be subjected to contamination by agricultural activities. Free ranging animals may excrete feces into water, and animals like cattle have a habit of wading into water and stirring up sediments. Rainfall can result in the run-off of fecal matter from agricultural and other rural lands into rivers, lakes, reservoirs and springs (Barrell *et al*., 2002). Management of fecal contamination of water would be improved if its sources could be accurately identified through water analysis. Human feces are generally perceived as constituting a greater human health risk than animal feces, but reliable epidemiological evidence is lacking. Irrespective of the relative risks, the ability to identify sources would assist in overall management of microbial water quality (Sinton *et al.*, 1998).

The results of this study showed that the relevant sanitary conditions and construction of sampled hand-dug wells water sources (33.2 %) of them did not have the habit to cover and several activities done around them such as irrigation, constriction and farming activity. These results show that water sources contaminated with inadequate sanitation practices that cause water-related diseases. So, the communities had no access to clean water and are highly vulnerable to catch waterborne and water-related diseases, such as thyphoid, giardia, amoeba, cholera, schistosomiasis, cryptosporidiosis, trachoma, leprosy diseases.

Due to poor hygiene practices of use of toilets people were vulnerable to fecal-oral diseases, such as ascariasis, hookworm and hepatitis (Curtis *et al*. 2000). Based on this fact 88 % of residents had pit latrine without water facility and poor quality which constricted from wood, plastic, chipwood and grass. The unavailability of household toilets facility and sanitation condition would automatically great source of pollution to the environment and heavy runoff water may wash faeces into nearby water bodies to cause contamination. Their water source could easily be polluted leading to increase in water-borne diseases in the community.

Observation of sanitation practice was undertaken to help the researcher obtain first hand information about the sanitation behavior of the community that is essential to promote health and prevent diseases. The relevance is due to the fact that associated with the availability of adequate waste and excreta disposal facilities and their hygienic use are an integral part of primary health care (Water Aid, 2009). From the direct observation of the study area 41.9% (n=121) of the households did not use sufficiently large wastes collecting sacks and throw the wastes everywhere.

Solid wastes like food waste, paper, rubbish, ashes, plastic and improper management of liquid wastes were observed in the study area. As a result people dispose wastes in open area which has risk for health and may result environmental pollution and occurrences of bad smell. The community can cause by diseases and affect breathing system. Health extension workers reported that education had been given to the community once every month (on the 29th of each month) on sanitation, water treatments and prevalence of diseases. But this is not enough because of community cannot easily understood about environmental pollution and disposal mechanism of wastes, which is dangerous for health. Diarrheal diseases attributed to poor water supply, sanitation and hygiene.

In rural areas of Ethiopia, water for human consumption, drinking, washing (bathing, laundry), for preparation of food etc, is obtained from rivers, streams, shallow wells, springs, lakes, ponds, and rainfall. Unless water is made safe or treated for human consumption, it may be hazardous to health and transmit diseases. The main contaminants of these water sources are human excreta, animal waste under poor environmental sanitation condition. Thus, the majority of rural communities use water from contaminated or doubtful sources, which expose the people to various water-borne diseases (FDRE, MoWR, 2004). Diseases related to water, sanitation, and hygiene disproportionately affect poorer sanitation practices of society. The reasons behind this are complex and interconnected.

The estimate presented here represents the disease burden due to water, sanitation, and hygiene from a selected community more than 315 patients are affected by waterborne diseases. The diagnoses indicated 59 % of them contracted typhoid fever, ameboisis ,giardiasis cholera, and others Taeniasis, Bacillary Dysentery. Data from residents showed that 33 % of residents were experience waterborne diseases in January to April and during rainy season .As we have shown, quantification of the disease burden due to water, sanitation, and hygiene is a complex task because of the numerous interrelated causes leading to

transmission of water-related diseases as source factors, pathway factors, behavioral factors and complex exposure patterns at household and community level.

Source of safe water, toilet facility, habits of water treatment usage water and environmental sanitation practices were suspected to be the major factors responsible for the occurrence of waterborne/diarrheal diseases reported by the Water Aid (2009). Furthermore, this study indicated that well water used as a Primary water source was significantly associated with diarrhoeal episodes in the study households. Participants who used well water as their water source were more likely to get diarrhoeal symptoms than those who used other water sources. About 47.9 % of people affected by diarrheal cases diseases in this year use well water source for drinking, the rest who maintain their basic water access are getting from collected rain water sources. The Chi -square test results, indicated highly significant relationship between water sources with waterborne diseases(P-value of 0.000). Similarly, water treatment mechanism also shows a significant relationship with waterborne diseases (p- value of 0.001). The ones who do not use water treatment like agar, chlorine or boiling which affected by waterborne diseases than use treated water.

Prevalence of waterborne diseases was not significantly association with toilet facility and toilet facility without water(p value 0.5 and 0.37 respectively). Under environmental sanitation condition people who had not dump site more affected by diarrheal diseases than had dump sites which significantly associated with waterborne diseases (p value 0.000). So, unsafe drinking water, poor toilet facility and poor environmental sanitary practices also a major factor for prevalence waterborne diseases in study area.

According to Crump *et al.* (2005), ignorance on waterborne diseases may also play an important role in health awareness in households. Based on this fact participant's awareness about causes and prevention of waterborne diseases as 12.9 % of the respondents identified contaminated water as the possible cause while 53.8% thought it was caused by use contaminated water for domestic purpose, other 33.2 % respondent's poor habits of hand washing after and before eating food. Some health measures to prevent diseases can be undertaken by the community as a whole; these include water source protection, proper disposal of solid waste and excreta, wastewater drainage, controlling animal rearing and market hygiene. In addition to diarrhoea prevention practices at the household level, home treatment has been recommended in order to manage diarrhoea cases, thus reducing the burden of childhood diarrhoea (UNICEF/WHO, 2009).

The awareness of community on prevention method of diarrhoeal diseases, 43% of the respondents indicated that they treated their drinking water and 36% washed their hands to prevent it, the rest take and keep water in clean and closed continuers and use clean toilet. In addition to these improvements in wastes water disposal, protection of water sources, treatment of water supply has greatly reduced the prevalence of waterborne diseases. Home treatment of waterborne diseases is an essential part of the correct management of acute diarrhoea. The treatment package focuses on two main elements, as laid out by the UNICEF and WHO: Fluid replacement to prevent dehydration and zinc treatment. Oral rehydration therapy is the cornerstone of fluid replacement. New elements of this approach include lowosmolarity Oral Rehydration Solution (ORS), which are more effective at replacing fluids than the previous ORS formulation, and zinc treatment, which decreases diarrhoea severity and duration. Important additional components of the package are continued feeding, including breastfeeding, during the diarrheal episode and use of appropriate fluids available in the home such as sugar-salt solution if ORS are not available (UNICEF/WHO, 2009).

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

This study was conducted in Ude rural town oromia regional state, Ethiopia, related to water supply Sanitatization and prevalence of water borne diseases. To our knowledge this is the first water sanitation and prevalence of waterborne diseases study conducted in Ude rural town communities. The results obtained in this study may be used to extrapolate sanitation conditions and assess prevalence of waterborne diseases. The prevalence rate of typhoid fever was found to be the highest in the study site, ameboisis and giardiasis being the second and third prevalent waterborne diseases. The secondary data obtained from health centers in the town supported our result in that there was a high prevalence of waterborne diseases in the area. A total number of 315 cases were registered to have diarrheal diseases in this four-month report (2017).

Majority households got their daily water entirely from well but the well does not have the habit to cover and situated in a bushy environment which close dump places that easily contaminated with human and animal wastes. While, the rest used rain water collected during rainy season drinking without treating; others resident households practiced boiling and add agar during rainy season. The well water can easily be contaminated by flood entering the wells and some of them practiced traditional water treatment system like filtering with cloth. This might be dangerous for the people that might be vulnerable to waterborne disease. This can be explained that a method of treating water eliminates all the possible water pathogens. Most of residents had pit latrine without water facility which construct from wood, plastic, chipwood or grass.

Environmental sanitation is essential to promote health and prevent diseases. However, in the study area food waste, paper, rubbish, ashes and residues, plastic and improper management of liquid wastes were the main solid and liquid wastes that easily contaminate well water. Awareness regarding to water and environmental sanitation, use of water treatment, water handling practices, knowledge of the cause and prevention method of waterborne diseases, aimed at preventing or minimizing the risk. Source of water, disposal of wastes and use of water treatment were possible major factors that significantly associated with the occurrence of waterborne/diarrheal diseases but presence of toilet and use without water facility were not significantly associated.

6.2 RECOMMENDATIONS

On the basis of the findings of this study the following points can be recommended:

1. Safe potable water sources should be provided to improve the welfare of residents of Ude rural areas and to reduce the prevalence of waterborne diseases in the areas.
2. Quality assessment of the water source should be conducted to assure that safe drinking water of national quality standards is available to everyone.
3. Awareness programs give by health workers that related to use water treatment, water quality, importance of use of toilets, proper disposal of swages mechanisms and cause and prevention of water borne diseases that should be carried out in the rural areas to improve the status of public health, Water and environmental sanitation should be conducted on a regular basis to assess risks of contamination in water sources.
4. Future studies are needed to determine the seasonal variations of prevalence of waterborne diseases and conduct on water and environmental sanitation

5 .The government should support the private sector and NGOs that deals with water access, sanitation and hygiene program that reduce prevalence of sanitation related diseases.

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APPENDICES

Appendix A: Questionnaires used for data collection

ADAMA SCIENCE AND TECHNOLOGY UNIVERSITY

SCHOOL OF APPLIED SCIENCE

PROGRAM OF BIOLOGY

MSc PROPOSAL

Questionnaires

Dear respondents! The purpose of these questionnaires are designed for the study to assessment of Water Sanitation and Prevalence of waterborne diseases Ude rural town in districts of Adea, oromia, Rigional, State. This questionnaire is filled out by respondents selected randomly from the area. Since the quality and success of this study depends on the information you supply. You are kindly requested to provide your genuine response. Right at the outset, would like to assure you that your response will be used only for research purposes and will be kept confidential.

Zinash Dessie

Telephone: 0920857706

Thank you in advance!

I. personal information of the respondents:

1. Sex: Male ☐
   Female ☐
2. Age:
   A.20 - 30 ☐
   B.31 - 40 ☐
   C. 41 -50 ☐
   D. > 50 ☐
3. Marital Status: A. married ☐
   B. Single ☐
4. Occupation: A. Farmer ☐
   B. House wife ☐
   C. Civil servant ☐
5. What is the education attainment of the head of household?
   A. 1-4 ☐
   B. 5-8 ☐
   C. 9-10 ☐
   D. 11-12 ☐
   E. college ☐
   F. University complete ☐

II. Assessment of water sanitation and prevalence of waterborne diseases.

1. What is the main source of drinking water use members of households?
   A. open well water ☐
   B. Rainwater collection ☐
   C. pipe water ☐
   D. Surface water (rivers/lakes) ☐
2. Is there any dump site found around each household's compounds?
   A. Yes ☐
   B. N0 ☐

3. Water sources that used by community covered well?

A. yes ☐

B. No ☐

4. What type's activity done around water sources?

A. Irrigation ☐

B. constriction ☐

C. Others activities ☐

5. Is there any water contaminants found around in the well?

A. Yes ☐

B. No ☐

6. What types of contaminants that found around water sources?

A. Animal wastes ☐

B. Agricultural products ☐

C. Human faces ☐

D. Others ☐

7. Do you treat your water in any way to make it safe to drink?

A. Yes ☐

B .No ☐

8. If your answer to question 3 above is "**yes**" what types of treatment do you use?

A. Boiling ☐

B. Adding Agar/chlorine ☐

C. Sieve it through cloth ☐

D. Water filter (ceramic, sand) ☐

E. others ☐

9. Do you have toilet facility in your house?

A. Yes ☐

B. No ☐

10. Is there water facility in the toilet?

A. Yes ☐

B. No ☐

11. When you wash your hand after using toilet?

A. Always ☐

B. Sometimes ☐

C. never ☐

12. Do you know about Diarrheal disease?

A .Yes ☐

B. No ☐

13. What are the main cause of this diseases?_____;

_____,_____,_____

_____

14. In which season these diseases observed it?

A. during rainy season ☐

B. during dry season ☐

C. undecided ☐

15. What types of measurement do you take it? _____

_____

_____

APPENDIX B: Interview designed for Health Extensions workers:

Questionnaire to assess how Ude rural town households use treated water, disposal of wastage and prevalence of waterborne disease.

1. Is there any data about Ude rural town community sources of water?

A. Yes ☐

B. No ☐

2. What types of water sources use for domestic purpose?

A. well water ☐

B. collected rain water ☐

C. spring water ☐

D. pipe water ☐

2. How many of them do you expect using well water?

_____

_____.

3. How to use this well water? _____

_____

_____

4. What types of water treatments use? _____

_____

_____

5. Do you think that community dispose wastes properly?

A. yes ☐

B. No ☐

6. When and how many times give education about use of water treatment, disposal of swage (environmental sanitation),use of toilet and prevalence of waterborne disease?_____.

7. What type's measurement do you take to reduce the prevalence of water borne diseases?

_____

_____

_____.

APPENDIX C: Observational guide

	Chick list	Criteria
1	Water sources	A. sources of used for drinking B. condition of clearness C. well cover it or not D. places where present it/around house, farming activity place or animal house place
2	Status of surrounding	A. Not clean at all B. somewhat clean C. partially clean D. Clean E. very clean
3	Household toilet	-Quality: A. good B bad C. relatively good
4	Waste dump places	A. have waste dump place B. not have waste dump place

APPENDIX D. Checklists for collecting secondary data.

1. In Ude rural town how many people's exposed by waterborne diseases?

2. In which season high prevalence of water borne diseases observes it?

3. What are the reasons for high prevalence?

4. What is the common water borne diseases records from January to April?

5. What is the frequency of each waterborne disease?

Univarsiitii Saayinsii Fi Teeknooloojii Adaamaa

Sagantaa Barnoota Baayoolojii

Msc

I.Odeefannoo dhunfaa kan hirmaataa

1 .Saala A. Dhiira ☐

B. Dubara ☐

2. Umrii A. 20-30 ☐

B. 31-40 ☐

C. 41- 50 ☐

D. >50 ☐

3. Haala Fuudhaafi Heerumaa

A. KanFuudhee/Kanheerumte ☐

B. Kanhinfuune/kanhinhearumne ☐

4.Hojii A. Qonnaan Bulaa ☐

B. Haadha Manaa ☐

C. Hajeetaa Mootummaa ☐

5 .Haala Barnootaa

A. 1- 4 ☐

B. 5- 8 ☐

C. 9- 10 ☐

D. 11-12 ☐

E. kolleejii ☐

F. Barnoota Univarsiitii kanaxumure ☐

II. Gaaffii Qulqullina Bishaanii fi Dhukkuboota Bishaanii dhufaan

1.Madii Bishaan Dhulqaatti hawaasichaa maali?

A .Bishaan bollaa ☐

B.Bishaan bokkaa ☐

C Bishaan ujummoo ☐

D.Bishaan lagaa ☐

2. Bisaan lafa irratti kufamee moraa /dallaa/ hawaasichaa keessatti ni jira?

A .Eeyyee ☐

B. Lakkii ☐

3.Madii Bishaani hawaasicae sirnaan hojjatamee jira?

A. Eeyyee ☐

B. Lakkii ☐

4. Dalagaawwan akkami naanno mada bishaanichaattii hojjatamu?

A. Jallisa ☐

B. Ijaarsawan adda adaa ☐

C. kan biroo ☐

5. Edoo bishaanichaati wantooti faalluu danda'an ni jiru?

A. Eeyyee ☐

B. Lakkii ☐

6. Wantoota akkamitu bishaanichi falluu danda'u?

A. Dhoqee horii ☐

B. Basbosawwaan Qanae irraa argaman ☐

C. Udaan /xuraawae/ namootaa ☐

D. Kan biro ☐

7. Bishaan dhugaattif fayyadamtan ni yaaltuu?

A. Eeyyee ☐

B. Lakkii ☐

8. Gaaffii arman elitti deebin kee eeyeen yoota'e bishaan akkamiit yaaltae?

A. Danfisun ☐

B. Kiloorini itti naqun ☐

C. Dhimbiibu / calalan/ ☐

D. Calaahun cirachaa fayyadamu ☐

E. kan biro ☐

9 . Mama fincaani ni qabduu?

A. Eeyyee ☐

B. Lakkii ☐

10. Mana fincaanichatti bishaan ni argama?

A. Eeyyee ☐

B. Lakkii ☐

11. Erga mana fincaanitti fayyadamtee booda harka kee yoom dhiqataa?

A.Yeroo hundaa ☐

B. Yeroo tokkoo tokkoo ☐

C. Gonkummaa ☐

12. Waa'ee dhukkuba garaa kassaa ni beektaa?

A. Eeyyee ☐

B. Lakkii ☐

13.Sababii buu'uraa ummamuu dhibbee kanee malii?_____

_____

14. Dhakuubnii kun waqtii kam keessatii muldhatee?

A. Yerroo Gannaa ☐

B. Yerroo bonaa ☐

C. Hin murtefamu ☐

15. yaalii akkamii taasistu?_____

_____

_____.

Galatoomaa!!!